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and then, although it may be frozen at the surface, it continues to flow over a perfectly clear bottom. All these phenomena are considered by the author as perfectly explicable on the theory he advances, of different degrees of radiation of heat occurring from the bottom according to variations of circumstances. He conceives that when this radiation takes place from the solid opaque materials of the bed of the stream, through the stratum of transparent water, congelation is induced on that portion of fluid, already cooled down to the freezing-point, which is in immediate contact with the radiating body. The circumstances which, by favouring radiation, contribute to this effect, are, principally, great clearness of the sky, and great transparency of the water; the bottom of the river being cooled below the freezing-point sooner than the water which is flowing over it; and the ice, formed at the bottom, remaining attached to it, as long as the heat which is transmitted from below continues to be lost by radiation. The formation of ground-ice is favoured by the intestine motions incident to a rapid current; because the different strata of fluid, which in still water would have arranged themselves, according to their specific gravities, in the order most conducive to the congelation of the surface, being continually mixed together, the whole body of water is cooled more uniformly.

The Society then adjourned over the Easter recess to meet again on the 30th instant.

April 30, 1835.

The REV. PHILIP JENNINGS, D.D., Vice-President, in the Chair.

A paper was read, entitled, "Continuation of the paper on the relations between the Nerves of Motion and of Sensation, and the Brain; and more particularly on the structure of the Medulla Oblongata and of the Spinal Marrow." By Sir Charles Bell, F.R.S.

The author enters into a minute anatomical investigation of the structure of the spinal cord, and of its relations with the encephalon, and with the origins of the nerves. He finds that the spinal cord is constituted, in its whole length, by six pairs of columns, namely, two posterior, two lateral, and two anterior; each column being composed of concentric layers, and invested with an external coating of cineritious substance, and all the columns being divided from each other by deep sulci, which penetrate nearly to the centre of the cord. On tracing the posterior columns in their ascent towards the encephalon, they are seen to diverge laterally at the *calamus scriptorius*, or bottom of the fourth ventricle, and to proceed into the substance of the cerebellum. Each of these posterior columns is here found to consist of two portions, the outermost being the largest; and they now constitute the *processus cerebelli ad medullam oblongatam*. This subdivision of the posterior columns may be traced throughout the whole length of the spinal cord. The lateral columns give origin to the posterior roots of the spinal nerves, and are therefore the parts subservient to sensation. In ascending towards the brain, each of these co-

lumns has a double termination ; first, in the root of the fifth pair of cephalic nerves ; and secondly, in the place where both columns unite into one round cord, and mutually decussate.

Between the lateral and the anterior columns there is interposed a layer of cineritious matter, constituting a continuous stratum from the *cauda equina* to the roots of the auditory nerves. There is also a septum, dividing the right and left tracts subservient to sensation in the region of the fourth ventricle, and apparently terminating at the point of decussation of these tracts ; but, in reality, separating to allow of this decussation, and joining the central portion of the cord, which connects the posterior with the anterior columns, and extends from the *pons Varoli* to the *cauda equina*.

The anterior columns, constituting, at their upper part, the *corpora pyramidalia*, after their union and decussation, compose the motor columns of the spinal cord. They do not, in their course, unite or decussate with the lateral, or sensitive columns ; decussation taking place only among the columns performing similar functions ; that is, the motor columns with the motor, and the sensitive with the sensitive.

May 7, 1835.

Sir JOHN RENNIE, Knt., Vice-President, in the Chair.

The first paper read was entitled, "On the Elements of the Orbit of the Comet of Halley in 1759." By J. W. Lubbock, Esq., V.P. and Treasurer of the Royal Society.

In calculating the elements of Halley's comet, former astronomers have in general adopted the parabolic hypothesis, neglecting the reciprocal of the semi-axis major ; and even in the more recent investigations of its orbit, no accurate value of this quantity has been employed. Mr. Lubbock, perceiving the serious effect which an error in the semi-axis major would occasion in the determination of the other elements, renewed these very laborious calculations, assuming as the value of this quantity that given by M. Pontécoulant, in his "*Théorie analytique du Système du Monde*;" taking also into account the alterations which the elements of the comet have undergone by the action of the planets, and likewise the effect of precession upon the longitude of the node, and of the perihelion. The author takes this opportunity of correcting the very erroneous statements that have been made respecting the results of his investigations, especially with regard to the time of the perihelion passage, which is, of course, very different from that of its actual appearance to spectators on the earth ; although these two epochs are frequently confounded with one another.

The second was entitled, "Formulæ for computing the Longitude at Sea;" by William Dunlop, Esq. Communicated by the Secretaries.

These formulæ, in which the longitude and latitude of two points in a spherical surface, together with the arc of the great circle intercepted between them, are supposed to be given, furnish the means